Girls Realizing Opportunities With STEM: GROW STEM	
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A. SIGNIFICANCE

A1. Development or Demonstration of Promising Strategies: *Girls Realizing Opportunities With STEM: GROW STEM* will test promising strategies for ***Absolute Priority 2: Improving Science, Technology, Engineering, and Math (STEM) Education*** through high quality STEM extended learning and mentoring experiences to inspire middle school girls' interest in STEM and improve achievement. Metropolitan Nashville Public Schools (MNPS) is a novice applicant and qualifies for the ***Competitive Preference Priority***. As the 42nd largest school district in the nation, MNPS is uniquely poised to develop and evaluate a comprehensive model to address challenges in meeting national STEM workforce shortages, particularly among high-need female students. The U.S. Department of Commerce projects there will be 1.2 million unfilled STEM jobs in the U.S. by 2018 (Langdon et. al., 2011) and females continue to be underrepresented in STEM, holding less than 25% of STEM jobs (Beede et. al., 2011). MNPS serves over 82,000 students in an urban district with 73% low-income, 45% African American, 20% Hispanic, and 15% English Language Learners (ELL). Despite students' socioeconomic and academic barriers, MNPS has closed achievement gaps and made significant improvements for all students, including an 18% increase in math proficiency, 12% increase in science proficiency, and 6% increase in reading proficiency over the last five years. Our district has also seen a 20% increase in its graduation rate over the last decade. Appendix C outlines these achievements and other improvements that qualify MNPS as an eligible i3 applicant. *GROW STEM* will be implemented and evaluated at seven Title 1 middle schools that serve some of our highest need students. Our target schools enroll 4,332 students with 83% low-income, 44% African American, 20% Hispanic, 6% Asian, and 13% ELL. Although each school has made gains, our high-need students still face challenges: on average, only 36% of target students scored proficient/advanced in math, 33% scored proficient/advanced in reading, and 43% scored proficient/advanced in science on state standardized exams (TN ED, 2014). ♦ ***Innovative Approach that Builds on***

***Existing Strategies*:** Recognizing the need to better prepare students for college and future careers, MNPS launched the Academies of Nashville in 2006, which has transformed high school education. Every MNPS high school offers career academies aligned with industry job projections, ensuring students are provided with the advanced skills they need to be successful in college, career, and life. Several academies have a STEM focus, such as engineering, information technology, biotechnology, and safety and security technology. After exploring career options in ninth grade, students select their academy focus and learn in a relevant, hands-on environment through problem-based learning (PBL) and real-world application (including industry field trips, job shadowing, and a senior capstone project). The initiative has been nationally recognized for its impact on student success, with every high school improving graduation rates, decreasing discipline referrals, increasing participation in advanced academics, and increasing achievement and ACT scores (MNPS, 2015). Academies of Nashville is nationally accredited through the National Career Academy Coalition and recognized as a Ford Next Generation Learning Community. During a November 2014 visit to one of MNPS's high schools, President Obama praised the district's improvements and success with the academy model. Although this model has been successful, there continues to be a persistent gap in the percentage of female students enrolling in STEM-themed academies: over the last two school years, just 36% of students enrolled in our STEM-themed academies were female (compared to 73% female enrollment in our health and human services academies). This isn't surprising based on national trends: the share of bachelor's degrees earned by women is 19% in engineering and 18% in computer science—the two fields experiencing the largest gender gaps (NSC, 2015). Through *GROW STEM*, MNPS will develop and evaluate the impact of a STEM extended learning and mentorship model for middle school girls that addresses the challenges of improving achievement and motivating girls to pursue STEM. *GROW STEM* is supported by a **strong theory**, as evidenced through research and our logic model (see Appendix D), and builds

on our successful academy model over the last nine years. Our program is innovative in its design to address a national STEM workforce shortage while helping to close the gender gap that exists in STEM fields, especially among female minorities. *GROW STEM* integrates four core strategies to demonstrate the impact of high-quality STEM extended learning and mentorship on academic achievement, STEM engagement, and STEM career aspirations for low-income, underserved middle school girls. **(1) STEM Extended Learning:** *GROW STEM* will provide STEM extended learning for 210 girls in grades 5-8 at seven pilot Title 1 middle schools (30 girls/school) that serve a primarily low-income and/or minority population, per Table 1.

Table 1: *GROW STEM* Target Middle School Demographics

School	# Students	% Low-Income	% White	% Black	% Hispanic	% Asian	% ELL
Bailey STEM Magnet	445	95%	13%	78%	6%	3%	5%
Croft Design Center	737	72%	40%	21%	32%	7%	16%
Goodlettsville Prep	538	86%	33%	48%	16%	2%	5%
Isaac Litton	340	83%	39%	54%	6%	2%	3%
Madison	756	90%	17%	65%	17%	1%	7%
McMurray	729	96%	18%	12%	50%	20%	49%
Oliver	787	56%	49%	31%	11%	9%	8%
TOTAL/AVERAGE	**4,332**	**83%**	**30%**	**44%**	**20%**	**6%**	**13%**

We have identified a rigorous and relevant STEM curriculum, *Engineering Everywhere (EE)*, to use as the foundation for extended learning. Developed by the Museum of Science in Boston, *EE* is a free out-of-school time (OST) curriculum for middle school students that is grounded in PBL, which research shows can increase interest in STEM related fields and improve academic motivation and achievement (Strobel & van Barneveld, 2009; Drake & Long, 2009). The curriculum was designed to improve academic achievement and youths' attitudes about their abilities to engineer, problem solve, and think creatively. Each thematic unit includes 6-10 activities that apply STEM concepts and take 45-60 minutes to complete. The curriculum is free for educators to download and includes detailed lesson plans, material lists, helpful background information, and online resources (i.e., video and audio segments). Each unit focuses on a real-

world problem and undergoes a rigorous pilot test and evaluation. *EE* is modeled on the Museum of Science's successful *Engineering is Elementary (EiE)* curriculum, a classroom curriculum that has reached over 59,000 teachers and nearly 5 million students nationwide and has had a significant impact on students' science performance and engineering aspirations, especially among minorities and girls (MOS, 2014). For example, a school in Raleigh, NC reported a 41% increase in the school's science scores after implementing *EiE* with 78% of students expressing interest in an engineering career (Hardee, 2015). The National Science Foundation has funded a large-scale efficacy study of the elementary *EiE* curriculum, which will be completed in 2017. *GROW STEM* will implement and assess the impact of the middle school *EE* curriculum in an extended learning setting with girls, which provides greater flexibility for expanding the model district-wide through established afterschool programs and for broader replication nationally in a variety of settings. Research shows that providing high quality, relevant, and more frequent STEM exposure in extended learning programs is critical to increase interest in STEM, improve academic achievement, and increase enrollment in more rigorous science and math classes (Krishnamurthi et. al., 2013). Compared to traditional instruction, PBL raises long-term retention of content, helps students perform as well or better than traditional learners in high-stakes tests, and improves problem-solving and attitudes towards learning (Strobel & van Barneveld, 2009; Walker & Leary, 2009). Further, PBL instruction has been shown to improve student engagement, motivation, and academic achievement in STEM, particularly among female students (Liu et. al., 2014). *EE* offers instructional modules that cover a broad set of real-world STEM topics, such as urban landscapes, insulated homes, safety helmets, bioplastics, prosthetics, and a pandemic response. Through its hands-on, PBL framework, *EE* challenges students to solve real-world problems and apply STEM to their everyday lives. The curriculum helps build a strong foundation in middle school for further STEM learning in high school. *EE* is aligned with Common Core Standards, Next Generation Science Standards, and National Science Education

Standards. *GROW STEM* will contribute to research on *EE* and successful STEM extended learning strategies by evaluating the impact of the curriculum on high-need middle school girls. To ensure girls get broad exposure to the range of STEM opportunities, we will supplement *EE* with additional STEM units offered by the University of TN (UT) Extension office that are research-based and grounded in PBL. These STEM units will be offered during monthly Saturday sessions and will be selected based on students' identified interests and gaps in topics not covered by *EE*. Table 2 outlines extended learning strategies, which will provide **285 hours of STEM extended learning** annually.

Table 2: *GROW STEM* Extended Learning Strategies	
Afterschool Girls STEM Clubs	Each school will offer an Afterschool Girls STEM Club for 30 girls (2 days/week, 2 hours/day, 40 weeks; **160 total contact hours annually**). Led by two Lead STEM Teachers at each school, the afterschool clubs will provide broad exposure to hands-on, PBL STEM instruction using *Engineering Everywhere*. Girls will explore a broad range of STEM topics (i.e., urban landscapes, insulated homes, safety helmets, bioplastics, prosthetics, pandemics, bioinspired gear, etc.).
Saturday STEM Sessions	We will offer monthly Saturday STEM Sessions for middle school girls at three feeder high schools (30 students/high school, 5 hours/day, 10 sessions/year; **50 contact hours annually**). Sessions will build on afterschool activities and provide more in-depth exposure to STEM via STEM instruction provided by UT Extension, STEM field trips, STEM speakers, and STEM mentoring (peers in STEM academies, female STEM college students, and STEM professionals).
STEM Summer Camps	We will offer theme-based STEM Summer Camps at three high school sites (2 weeks in Year 1 to launch program and 3 weeks in Years 2-5; 45 students/site; **75 contact hours annually**). We will build on the afterschool program and Saturday sessions by exposing girls to a specific camp theme (i.e., Engineering, Robotics, Coding, or Energy & Sustainability). Each camp will include an introduction to the theme with PBL activities using *EE*; STEM field trips; STEM speakers; and STEM mentoring. Themes will be adjusted each year based on student interest.

Transportation will be provided for all extended learning activities to reduce barriers to participation. For Afterschool Girls STEM Clubs, we will use transportation available through afterschool programs currently offered in six of our seven target schools, which will help reduce program costs and support sustainability. To have the most significant impact, it will be critical for girls to regularly participate in all three program components and to continue the program over multiple years as a cohort so we can assess the impact of the program based on the level of

participation and track their progression into high school academies. To foster ongoing STEM inquiry and encourage full participation in *GROW STEM*, our business partners will donate STEM supplies and materials to the program, as well as provide incentives to students who complete all three components (Afterschool Girls STEM Clubs, Saturday STEM Sessions, and STEM Summer Camp). **(2) STEM Professional Development (PD):** Each school will identify two Lead STEM Teachers to lead afterschool, Saturday, and summer STEM instruction. Lead Teachers will play a critical role in aligning extended learning with school curriculum, fostering STEM collaborations with other teachers, and building a STEM culture in the school to sustain program impact. Research shows STEM programs are most effective when teachers are properly trained and have a strong STEM grounding (Howard-Brown, et. al., 2012). A study funded by the U.S. Department of Education (U.S. ED) revealed that the use of PBL can have a positive impact on the way teachers view students' academic abilities and can reveal previously unseen academic potential in reluctant learners (Gallagher & Gallagher, 2013). Researchers have also recognized that science teacher effectiveness is correlated with future science achievement and pursuit of science-related careers (Bolshakova et. al., 2011). To build STEM content knowledge and instructional skills, *GROW STEM* will incorporate several PD strategies, as Table 3 outlines.

Table 3: *GROW STEM* Professional Development Strategies	
Engineering Everywhere PD and STEM PLC	STEM Lead Teachers will participate in *EE* PD workshops, which will be offered at MNPS. One of our local partners, Dr. Stacy Klein-Gardner (Director of the Center for STEM Education for Girls at Harpeth Hall School), is a certified *EE* trainer and will lead PD efforts; provide ongoing guidance on implementation; and help support sustainability through ongoing support. STEM Lead Teachers will also participate in a STEM PLC, which will collaborate virtually each week and meet monthly for continued support.
STEM Externships	Through several partners, MNPS offers Teacher Externships to help teachers develop PBL curriculum in a real-world setting to provide students with industry exposure and applied learning. STEM Lead Teachers will participate in STEM externships each summer to expose them to real-world industry and support PBL curriculum development to use in extended learning activities.
STEM Conferences	To increase exposure to best practices in STEM education and to disseminate i3 results to a broader audience, STEM Lead Teachers and program staff will attend at least one STEM conference annually, such as the National Science

	Teachers Association Annual STEM Forum, Center for STEM Education for Girls conferences, and Tennessee STEM Innovation Hub conferences.
PBL Training and Support	MNPS is committed to integrating PBL across the district and has provided PBL training via the Buck Institute for Education in all MNPS high schools to support rigorous and relevant curriculum and student engagement. Beginning in the 2015-16 school year, MNPS is extending PBL training from the Buck Institute into its middle schools. STEM Lead Teachers will participate in this training, which will further develop their PBL instructional approach and help build a culture for STEM and PBL instruction across the district.

(3) STEM Mentoring: Lack of STEM identity and limited exposure to female STEM role models have been cited as major barriers to STEM persistence for females and minorities (Krishnamurthi et. al., 2014). However, there has been limited research to document the impact of female STEM mentors on girls' academic achievement in math and science and STEM interest. To address this challenge, *GROW STEM* will incorporate STEM mentoring, including peer mentors (high school females in STEM-themed academies), female college mentors (STEM majors), and female STEM professionals. As Table 4 shows, the three high schools serving our feeder middle schools offer a variety of STEM academies that we will draw on for peer mentors.

Table 4: STEM-Themed Academies at Feeder High Schools	
Hunters Lane	Academy of Design & Technology
John Overton	Academy of Information Technology; Academy of Engineering; Academy of Biotechnology Health Sciences
Stratford STEM Magnet	Academy of National Safety & Security Technologies; Academy of Science & Engineering

Mentors will meet individually and/or in small groups with mentees in selected afterschool, Saturday, and summer camp activities. Each *GROW STEM* participant will receive at least 4 hours of mentoring each month via in-person meetings, in addition to support from mentors through email and phone check-ins. High school peer mentors will participate through a required senior capstone class within their academy that includes a community service component. We will recruit female STEM college students through our partnerships with several surrounding universities and STEM professionals through our network of more than 60 business partners (see Appendix J) who work with the STEM academies at our three target high schools. Mentors will

play a critical role in helping girls envision themselves in STEM and encourage girls to pursue STEM-themed academies as they transition to high school.

(4) STEM Awareness, Recruitment, and Retention: A number of researchers have noted that parental expectations and involvement can facilitate the success of racial and ethnic minority students—Black students in particular—in STEM fields (Museus et. al., 2011). In our target schools, families have limited awareness of STEM opportunities, which further impedes girls' interest in STEM. To help shift this culture, we will implement a comprehensive marketing and recruitment plan. High school students in design courses and/or media classes will help design a logo to brand the program, develop a website, and develop short videos/Ted Talks for female students to encourage their participation. We will partner with Nashville Public Television to release these videos and short Public Service Announcements (PSAs) to raise awareness for our program and STEM opportunities. MNPS will host recruitment sessions at target middle schools and feeder elementary schools to raise STEM awareness and encourage students to apply for the program. Students will complete an application and interview process to assess their interest and commitment to the program, as well as the socioeconomic and other barriers they face that may impede their future pursuit of a STEM career. Our goal is to serve the highest need female students in our district who will benefit most from a targeted STEM intervention program. MNPS also has a strong network of Family and Community Engagement Specialists who support families; these Specialists will assist with marketing, recruitment, and outreach to students and families. We will host an annual **STEM Showcase** allowing girls to present on STEM topics and build excitement for STEM throughout their school and community. As detailed in our letters of support (Appendix G), several partners will help us raise awareness through other STEM programs, events, and networks in the region.

A2. National Significance: *GROW STEM* responds to a growing STEM crisis that threatens the nation's economic well-being. The U.S. Department of Commerce estimates STEM jobs will

grow 17 percent by 2018—nearly double the growth for non-STEM fields—and the U.S. will have more than 1.2 million unfilled STEM jobs by 2018 (Langdon et. al., 2011). For women, the STEM outlook is grim: from 2004 to 2014, the share of bachelor's degrees earned by women decreased to 19% in engineering (NSC, 2015). Underrepresented minorities earn just 18.9% of STEM degrees, with the lowest degree attainment in engineering (12.9%) and computer science (19.4%) (NSF, 2015). Women hold less than 25% of STEM jobs, and only one in ten STEM professionals is a minority woman (Beede et. al., 2011). In Tennessee, the STEM workforce shortage is staggering: STEM job postings outnumber unemployed people by 2.1 to 1 (Change the Equation, 2015). In the Nashville metro region, we face similar trends, with local industries reporting increasing challenges recruiting qualified STEM candidates and an ever-shrinking pool of female STEM professionals. With the identified gaps in STEM workforce diversity across our nation, it is imperative that strategic interventions be made during the middle grade years to engage female, underrepresented minority students in meaningful, real-world STEM learning experiences that will help boost their achievement, build confidence, and inspire them to pursue STEM fields. The middle grades are a critical time in a child's development, as failure to take preparatory high school courses in science and math during this time—as well as decreased interest in these areas because of low self-efficacy—can obstruct the pursuit of STEM careers (Bolshakova et. al., 2011). Using longitudinal data from the National Center for Educational Statistics, one study found students who reported STEM career interest in eighth grade were two to three times more likely to earn a STEM degree a decade later (Tai et. al., 2006). Researchers at Harvard examined several STEM out-of-school time (OST) programs and found that there is limited research on OST programs focused on STEM education for girls to document best practices, implementation, cost-effectiveness, and impact (Chun & Harris, 2011). In addition, while there are several STEM programs targeted toward girls nationally, there is limited research focused on the impact of STEM extended learning on middle school girls that incorporates quasi-

experimental design (QED). There are also no QED studies assessing the impact of *Engineering Everywhere* and the impact of the curriculum on girls' interest and persistence in STEM. *GROW STEM* will test a strong **theory of change** by implementing a QED evaluation to examine the impact of STEM extended learning and STEM mentoring in an urban setting on middle school girls who are predominantly low-income and/or minority. Since the nation's urban schools are serving the majority of high-poverty and high minority populations, who are underrepresented in STEM fields, MNPS (the 42nd largest district in the nation) provides the ideal diverse environment to conduct a QED study of the impacts of a comprehensive STEM extended learning and mentoring model. We will also study teacher efficacy in the application of PBL pedagogy, application of STEM tools and research, and level of collaboration with other STEM teachers. Our program is innovative in its focus on middle school girls using the *Engineering Everywhere* program in an extended learning setting throughout the school year and summer; its integration and study of the impact of STEM mentoring on girls' engagement and interest in STEM; and its examination of teacher efficacy in PBL STEM instruction and the impact of PBL and teacher collaboration on improving STEM interest and achievement. Our model builds upon successful strategies identified within our high school academies that will allow us to extend and intensify our focus on preparing students to pursue STEM majors in college and future STEM careers. *GROW STEM* will also impact a new nationally-recognized initiative in the state—Tennessee Promise—a scholarship and mentoring program providing a last-dollar scholarship for students attending any of the state's community colleges, colleges of applied technology, or other eligible institutions offering an associate's degree. Tennessee Promise, the first program of its kind in the nation, has become a national model and was launched, in part, to help meet growing workforce shortages in technical STEM fields. By improving STEM engagement in middle school and the transition into high school STEM academies, *GROW STEM* will strengthen the pipeline of students who can take advantage of Tennessee Promise. Results from

our QED study will provide data to advance theory, knowledge, and practice and inform national policy and standards related to STEM education and extended learning for girls to address STEM workforce shortages. Key research contributions with national significance include: (1) evidence of the impact of high-quality, research-based STEM extended learning integrating PBL instruction on improving proficiency in math and science, STEM engagement, and STEM career aspirations among predominantly minority, low-income middle school girls; (2) a tested model measuring the impact of *Engineering Everywhere* in an extended learning setting with girls; (3) evidence of the impact of regular, sustained STEM mentoring from peers, college students, and professionals on STEM engagement and aspirations among girls; and (4) evidence of the impact of teacher efficacy in PBL STEM instruction on STEM interest and achievement among girls. Studies highlighted in Appendix D provide further documentation of the promising practices *GROW STEM* builds on and the national significance of the project.

A3. Potential Replicability: *GROW STEM* is designed to expand our district's current STEM strategies targeting high school students to an evidence-based model targeting female middle school students who are at a critical point in determining STEM career aspirations. *GROW STEM* will inform multiple areas of impact in STEM education for girls—extended learning, mentoring, teacher professional development, and awareness and marketing efforts—that will help us develop and evaluate a model for large-scale replication in a variety of settings. This model will be tested for efficacy and refined via our QED evaluation design, which will document the impact of key strategies that can inform future development and replication of STEM programs targeting girls, as well as other underserved youth who may benefit from targeted STEM support in middle school. To support broad replication, we will create a *GROW STEM* Implementation and Replication Guide to document key strategies, partnerships, staffing, and evaluation outcomes. The use of *Engineering Everywhere* will further enhance replication because the curriculum is available free for download and outlines learning goals, alignment with

standards, and materials necessary to carry out the PBL STEM units (which are readily accessible and inexpensive). There are no current QED studies documenting the impact of *EE;* our program results can inform future use of the curriculum and impact on high-need middle school girls. Our focus on STEM extended learning also supports broader replication, as schools often have greater flexibility incorporating STEM into an afterschool setting (vs. creating a STEM school day course). Other districts or organizations could implement the entire model or choose specific strategies to enhance programs they already have in place. As detailed in Section B4, we will work through a variety of national networks to disseminate our replication guide.

B. QUALITY OF PROJECT DESIGN

B1. Goals, Objectives, and Outcomes: Our **overall program focus** is to build capacity for high-quality STEM extended learning and mentoring for low-income, underserved middle school girls to improve achievement, inspire STEM aspirations, and address gaps in the STEM education pipeline. As Table 5 shows, our program goal and objectives will document measurable results and have been aligned with our program model (described in Section A).

Table 5: *GROW STEM* Goal and Objectives
PROGRAM GOAL: Grow student achievement, heighten STEM aspirations, and close opportunity gaps in the STEM education pipeline through implementing mentorship and STEM extended learning strategies for low-income middle school girls.
Objective 1: Schools will implement the key program components of *GROW STEM* with 75% fidelity or more by the end of Year 1; and with 80% fidelity or more in each of Years 2-5. **Measure/Timeline:** Evaluator-developed fidelity index, compiled annually.
Objective 2: At least 60% of students will participate in all three extended learning program components (afterschool; Saturdays; summer) in Year 1; 70% in Years 2-3; and 80% in Years 4-5. **Measure/Timeline:** *GROW STEM* enrollment records, compiled annually.
Objective 3: Each set of program sessions (afterschool; Saturdays; summer) will achieve an average daily attendance rate of 80% in Year 1; 85% in Years 2-3; and 90% in Years 4-5. **Measure/Timeline:** *GROW STEM* attendance and enrollment records, compiled annually.
Objective 4: By the end of Year 1, at least 70% of our participants will express a strong interest in pursuing a STEM related career; 75% in Years 2-3; and 80% in Years 4-5. **Measure/Timeline:** Revised Women in Science Scale (WISS-R), administered annually (Owen et. al., 2007). *Reliability*: Equality subscale α = .78; Sexism subscale, α = .75. *Validity*: Confirmatory factor analysis validates presence of two subscales.

Objective 5: By the end of Year 1, at least 70% of 8th grade participants will be able to identify the classes needed to take in high school in order to prepare for a STEM-related career; 75% in Years 2-3; and 80% in Years 4-5. **Measure/Timeline:** Student survey, administered annually.
Objective 6: By the end of Year 1, at least 60% of 8th grade participants will enroll in a STEM Career Academy in High School; 65% in Years 2-3; and 70% in Years 4-5. **Measure/Timeline:** School enrollment records, compiled annually.
Objective 7: By the end of Year 1, at least 70% of participants will report a strong sense of engagement in STEM activities; 75% in Years 2-3; and 80% in Years 4-5. **Measure/Timeline:** Revised Simpson-Troost Attitude Questionnaire, administered annually (Owen et. al., 2008). *Reliability*: Cronbach's alpha for all 5 subscales ranges from .70 to.81. *Validity*: Confirmatory factor analysis validates presence of five subscales related to engagement.
Objective 8: By the end of Year 1, at least 70 % of participants will report the ability to understand and use the range of skills related to the cycle of science inquiry; 75% in Years 2-3; and 80% in Years 4-5. **Measure/Timeline:** Science Process Skills Inventory, administered annually (Bourdeau & Arnold, 2009)**.** *Reliability*: Split-half reliability was .93. *Validity*: Pre-post using Cronbach's alpha ranges .84 and .94.
Objective 9: By the end of Year 1, at least 70% of participants will achieve a TVAAS gain score of 2.0 points or more in Math and Science; 75% in Years 2-3; and 80% in Years 4-5. **Measure/Timeline:** Student-level growth scores in Math and Science, compiled annually from TN Value Added Assessment System.
Objective 10: By the end of Year 1, at least 70% of participants will report satisfaction with the quality of the mentoring experiences offered in *GROW STEM*; 75% in Years 2-3; and 80% in Years 4-5. **Measure/Timeline:** Student survey, administered annually.
Objective 11: By the end of Year 1, at least 8 Lead Teachers will achieve a TVAAS gain score of 3 or more in Math and Science compared to previous year; 10 in Years 2-3; and 12 in Years 4-5. **Measure/Timeline:** Teacher-level growth scores in Math and Science, compiled annually.
Objective 12: By the end of Year 2, and for each subsequent program year, at least 55% of 8th grade *GROW STEM* participants will achieve a score of proficient or higher on TNReadyMath and Tennessee Comprehensive Assessment Program for science. **Measure/Timeline:** TNReadyMath and TCAP, compiled annually and disaggregated by subgroup.
Objective 13: At least 70% of Lead Teachers in *GROW STEM* will report an increased level of collaboration with fellow STEM teachers; 75% in Years 2-3; and 80% in Years 4-5. **Measure/Timeline:** Teacher Collaboration Assessment Survey (T-CAS), administered annually (Woodland et. al., 2013). *Reliability*: Cronbach's alpha for 3 sub-scales ranges from .91 to .95. *Validity*: Convergent and discriminant validity coefficients range from .58 to .83.

B2. Management Plan, Timeline, and Milestones: As detailed in Table 6, our program will be staffed by a Project Director (1 FTE), Project Specialist (0.5 FTE), STEM Coordinator (1 FTE), and two STEM Lead Teachers per target middle school, with in-kind support from district leadership, STEM teams at each middle school, and high school academy Directors and Coaches.

Table 6: *GROW STEM* Staffing and Management Plan	
District i3	District leaders and principals will meet quarterly to provide strategic

Management Team *Current MNPS staff*	direction and assist with partnership building. *Core members include:* Principals from target middle schools and three feeder high schools; Director of Extended Learning Programs; Director of Academies of Nashville; Director of Career and Technical Ed; Director of Research, Assessment, and Evaluation; Director of Community and Family Partnerships; Director of Learning Technology & Library Services; Director of Grant Management; Director of Federal Programs and Grants.
School-based i3 Management Team *Current MNPS staff*	Each target middle school will establish an i3 Management Team to coordinate with i3 program staff to support school-level implementation (i.e., recruitment, afterschool program, Saturday sessions, STEM Summer Camp, high school mentors, and STEM Career Academy alignment). These teams will include STEM Lead Teachers, an Assistant Principal, and Career and Technical Education (CTE) staff.
Project Director *To be hired; 1 FTE*	The full-time Project Director will have a master's degree in education (doctorate preferred); at least 10 years of experience in K-12 education; a minimum of 5 years of experience in educational administration; demonstrated experience in STEM education and teacher professional development; and experience facilitating extended learning programs. Responsibilities will include overall program oversight and leadership, including management of professional development components; working with the i3 team to plan afterschool, Saturday, and summer camp experiences; developing partners; recruiting mentors; marketing and recruitment; and working with the external program evaluators.
STEM Coordinator *To be hired; 1 FTE*	The full-time STEM Coordinator will focus on providing day-to-day oversight of STEM-focused afterschool, Saturday, and summer programs; ensuring fidelity of *EE* implementation; supporting marketing and recruitment; and assisting with collection of data for evaluation.
Project Specialist *To be hired; .5 FTE*	A part-time professional will support the Project Director by facilitating communications; coordinating meetings; managing contracts; monitoring timelines; documenting activities; supporting data collection; preparing reports; reviewing budgets; and overseeing time and effort reporting.
Academy Directors and Coaches *Current MNPS staff*	Our target middle schools feed into three high schools offering a range of STEM academies. The Academy Director and Coach at each school will collaborate with i3 School Management teams to recruit STEM mentors; develop industry partnerships for middle schools; and provide support as *GROW STEM* students transition to 9th grade STEM academies.
Family and Community Engagement Specialists *Current MNPS staff*	Our district-hired Family and Community Engagement Specialists will support STEM strategies for targeted girls by assisting with marketing and student recruitment; engaging families to support STEM strategies; and helping connect community partners and volunteers to our target schools to support extended learning and mentoring activities.
STEM Lead Teachers *To be hired on extended contracts*	We will hire two STEM Lead Teachers at each school to lead afterschool, Saturday, and Summer Camp activities. Lead Teachers will be current teachers within the school and will participate in an ongoing professional development program, including *Engineering Everywhere* training, STEM PLC, annual STEM conferences, PBL training, and externships.

External Evaluator	**External Evaluator, The Evaluation Group (TEG)**: Drs. Karyl Askew and Heather Scott of TEG, experienced STEM and i3 evaluators, will lead our independent evaluation. The TEG team has experience conducting large-scale evaluations with districts in the Southeast, including seven i3-funded projects. See Section C and Appendix F for full qualifications.

♦***Partnerships:*** MNPS has a strong record of community engagement and will work with 17 community partners and 60 business/industry partners who will support *GROW STEM* through in-kind and financial contributions and program support. These partnerships will be essential for district-wide replication and sustainability. Table 7 outlines commitments (also see Appendix G).

Table 7: Overview of Key *GROW STEM* Partners and Resources
State-Level: The Tennessee Department of Education (TN ED) will provide networking, professional development, and dissemination opportunities through the Innovative Educator Network; STEM and PBL professional development opportunities via the Mid Cumberland Center of Regional Excellence; and disseminate the *GROW STEM* Implementation and Replication Guide to school districts across the state.
District-Level: MNPS will coordinate and manage all partnerships and align district resources to support *GROW STEM* strategies, including in-kind staff time to support our Management Team, School-based i3 Teams, and Advisory Council; in-kind time for Academy Directors and Academy Coaches to collaborate with i3 middle schools and program staff on industry partnerships and peer mentoring; and in-kind time of Family and Community Engagement Specialists to provide linkages with families and community partners. MNPS will also provide in-kind staff time at comparison school sites for our QED impact study.
Institutions of Higher Education: MNPS will partner with several private and public universities and colleges: ♦**Vanderbilt Center for Science Outreach** will provide support via the Scientist in the Classroom program; teacher externships; professional development; software integration; literature and best practices on STEM careers; collaboration on summer programming; and placement of students and teachers in research laboratories. ♦**University of TN Extension** will provide research-based resources and initiatives across the state and curriculum materials for Saturday sessions; leadership training for high school mentors; and support for the annual STEM Showcase. ♦**Middle TN State University** operates a Women in STEM Center to collaborate with PK-16 educational communities on STEM support for females, Girls Raised in TN Science program to disseminate STEM education and career information to young women, and Expanding Your Horizons annual STEM conference targeting middle and high school girls. MTSU will provide *GROW STEM* with professional mentors in STEM fields; professional development; support for extended learning and mentoring strategies; and summer programming support. ♦**Trevecca Nazarene University** will provide STEM curriculum and professional development; mentoring; and research experiences. ♦**Nashville State Community College** will provide academic and professional STEM mentors.
Business and Private-Sector Partners: MNPS has secured commitments from several business partners: ♦**Nashville Area Chamber of Commerce** will assist us with linkages to

community partners and businesses; offer technical expertise; and support outreach efforts to recruit business partners. ♦**Nashville Technology Council** will provide linkages with industry partners for mentors; externships; career fairs and showcases; and feedback on curriculum. ♦**Harpeth Hall**, an all-girls private school, houses a Center for STEM and will provide volunteers to support STEM activities in target middles schools; professional mentors; summer programming support; best practices in STEM; professional development on the *Engineering Everywhere* program; and support for the annual STEM Showcase. ♦**Microsoft** will provide hands-on experiences at DigiGirlz Day events; access to training; career awareness; tours and demonstrations; mentors; and support via the Microsoft Student Partner Program. ♦Over 60 **Business and Industry Partners** working through the Academies of Nashville will be connected with *GROW STEM* to provide mentors in STEM fields; externships; job shadowing experiences; field trips; and presenters for Saturday Sessions and STEM Summer Camps.

Nonprofits: Several nonprofits will provide support for *GROW STEM*: ♦**Nashville After Zone Alliance (NAZA)**, is a nonprofit providing funding for afterschool programs in underserved communities. NAZA will create expanded learning opportunities in afterschool programming; coordinate scheduling, recruitment, marketing, and transportation to support afterschool clubs; provide funding for afterschool programs; share best practices; and provide transportation home from the Afterschool Girls STEM Clubs for students at Bailey STEM Magnet, Isaac Litton, Croft, McMurray, Oliver, and Madison Middle Schools, which will reduce program costs and support sustainability. ♦The **PENCIL Foundation** links community resources with MNPS schools and will assist with recruitment and tracking of STEM mentors and STEM externships; field trips; guest speakers; academic incentives; and financial enrichment. ♦**Alignment Nashville** brings together community resources to support MNPS and will assist with leveraging local funding and resources; share resources on best practices and evidence-based approaches; assist with planning Afterschool Girls STEM Clubs and summer camps; provide the framework for Art2STEM afterschool clubs; and help forge partnerships for STEM industry mentors and externships. ♦The **Middle TN STEM Innovation Hub**, part of a statewide public-private collaborative involving the TN DOED and the Battelle Memorial Institute, focuses on promoting STEM education and careers in middle TN. The Hub will help us expand professional development and externships for Lead Teachers; share best practices; engage students via STEM Expo opportunities; and disseminate the *GROW STEM* Implementation and Replication Guide statewide. ♦**Girl Scouts of Middle TN** will provide volunteers and mentors; host day camps, off-site experiences, and STEM programming; provide guidance on STEM best practices; and provide membership scholarships. ♦**Nashville Public Television** will assist with awareness and marketing efforts by airing short videos and PSAs to raise awareness for our program and STEM opportunities.

♦***Advisory Council:*** Meeting quarterly, the Advisory Council, led by our Project Director, will provide operation oversight. The Council will include the STEM Coordinator, one STEM Lead Teacher from each school, all Management Team members, high school Academy Directors and Coaches, our evaluation team, community partner representatives, and parent representatives. The Council will provide guidance on program strategies; link school staff to community

resources; review evaluation reports; provide the Management Team with operational guidance to address program challenges; guide the creation of a sustainability plan; and disseminate program information to other stakeholders. ♦***Management Plan Timeline:*** As Table 8 shows, our management plan timeline is carefully aligned with key program milestones and objectives.

Table 8: Project Management Plan and Timeline			
Milestones		**Timeline**	**Responsible**
Ongoing	Management Team (MT), led by the Project Director (PD), will guide/monitor implementation for continuous improvement	Monthly	PD, MT
	i3 School-Based Teams (SBTs) support school implementation	Ongoing	PD, SBTs, SC
	High School Academy staff support STEM alignment, Saturday and summer sessions, and coordination with industry	Ongoing	PD, SC
	Family & Community Engagement Specialists support outreach	Ongoing	PD, MT
	Advisory Council (AC) supports implementation, dissemination, and sustainability; meets for program updates	Quarterly	PD, AC
	PD, STEM Coordinator (SC), and STEM Lead Teachers (SLTs) attend STEM conferences to learn best practices and disseminate model	Annually	PD, SC, and SLTs
	Project Specialist (PS) provides ongoing program support	Ongoing	PS
	Evaluators (EV) conduct ongoing data collection/assessment; provide reports and guidance	Quarterly	EV
Year 1: January 1, 2016 – December 31, 2016			
1st Quarter	Hire SC, PS, and SLTs	3/15	PD, MT
	Collect baseline data, create surveys, and solidify comparison schools for QED study	3/15	EV, PD
	Plan for implementation and summer program launch; solidify summer camp themes	3/31	PD, PS, SC, SLTs, MT
	High school students in design/marketing academy courses assist with branding/marketing (logo, website, videos)	3/31	PD, SC, Acad. Staff
	PBL professional development provided by district for SLTs	3/31	PD, MT, SC
	Participate in *Engineering Everywhere* (*EE*) and PBL training; apply for STEM externships	3/31	SLTs
	Launch marketing effort in community and schools	3/31	PD, SC
2nd Quarter	Recruit first cohort at each school (incoming 5th-8th graders) for *GROW STEM* (summer camp, STEM Clubs, Sat. sessions)	5/15	PD, SC, SBTs, SLTs
	Hold orientation session for *GROW STEM* cohort	5/31	SC, SLTs
	Recruit peer, college, and professional mentors for each school	5/31	PD, SC
	Plan for implementation of 2-week summer camp	5/31	PD, SC, SLTs
	Complete *EE* and PBL summer training	6/30	SLTs
3rd & 4th	Hold 2-week summer camp at 3 high school Academy sites (5 hours/day), serving 45 students each	7/31	PD, SC, SLTs
	Collect baseline survey and evaluation data for students/teachers	7/31	EV
	Prepare for school-year implementation and launch of clubs	7/31	PD, SC, SLTs

	Participate in PBL training and STEM PLC (monthly)	9/30	SLTs
	Match mentors with participating students (4 hours/month)	8/15	PD, SC
	Launch Girls STEM Clubs (2 days/week, 2 hours/day)	9/1	PD, SC, SLTs
	Launch Saturday Sessions (1/month, 5 hours/session)	9/30	PD, SC, SLTs
	Complete U.S. ED annual report; document model/successes for Replication Guide; refine strategies for Year 2 as needed	12/31	PD, SC
Years 2-4: January 1, 2017 – December 31, 2019			
1st-2nd Quarters	Continue Girls STEM Clubs and Saturday sessions	5/31	PD, SC, SLTs
	Plan for 3-week summer camp; solidify themes	4/30	PD, SC, SLTs
	High school students in design/marketing academy courses assist with new marketing needs (videos, report graphics)	3/31	PD, SC, Acad. Staff
	PBL professional development provided by district for SLTs	5/31	PD, MT, SC
	Participate in *EE* training and apply for externships	5/31	SLTs
	Recruit additional students to fill openings (incoming 5th-8th graders for summer camp, STEM Clubs, Sat. sessions)	5/15	PD, SC, SBTs, SLTs
	Hold orientation session for Year 2 *GROW STEM* cohort	5/31	SC, SLTs
	Recruit peer, college, and professional mentors for each school	5/31	PD, SC
	Plan for implementation of 3-week summer camp	5/31	PD, SC, SLTs
	Hold annual STEM Showcase event	5/31	PD, SC, SLTs
	Complete *EE* and PBL summer training	6/30	SLTs
3rd-4th Quarters	Hold 3-week summer camp at 3 high school Academy sites (5 hours/day), serving 45 students each	7/31	PD, SC, SLTs
	Collect baseline survey and evaluation data for students/teachers	7/31	EV
	Prepare for school-year implementation activities	7/31	PD, SC, SLTs
	Participate in PBL training and STEM PLC (monthly)	12/31	SLTs
	Match mentors with participating students (4 hours/month)	8/15	PD, SC
	Launch Girls STEM Clubs (2 days/week, 2 hours/day)	9/1	PD, SC, SLTs
	Launch Saturday Sessions (1/month, 5 hours/session)	9/30	PD, SC, SLTs
	Complete U.S. ED annual report; document model/successes for Replication Guide; refine strategies as needed	12/31	PD, SC

Year 5: January 1, 2020 – December 31, 2020

In Year 5, implementation of key strategies continues per Years 2-4 management plan, with adjustments to project based on ongoing evaluation and feedback. Other key activities include:

- **January 1, 2020:** By the launch of Year 5 we will complete our Replication Guide and begin state/national dissemination; this guide will be updated and finalized at the conclusion of the project based on final evaluation results.
- **June 30, 2020:** Grant-funded program activities and staff conclude by June 30, 2020 as we transition to sustainability of program for the 2020-2021 academic year.
- **August 1, 2020:** Beginning with 2020-21 academic year, schools continue/sustain activities, as outlined in sustainability planning.
- **December 31, 2020:** Grant close-out and wrap-up of final evaluation and performance reports; final revisions to Replication Guide based on final evaluation results.

B3. Feedback and Continuous Improvement: *GROW STEM* incorporates several strategies and regular monitoring to support continuous improvement of the project. ♦***Advisory Council*:** As detailed above, the Advisory Council will meet quarterly to provide ongoing feedback and guidance on the operation and improvement of the program. ♦**i3 *Management Team*:** The Management Team, led by our Project Director, will meet monthly to review the status of project strategies, assess any needs related to extended learning, marketing/recruitment, and professional development strategies, review and confirm partner commitments, allocate resources, and develop and monitor an implementation plan to ensure the project is on target. The Team will conduct an intermittent review of our logic model (Appendix D) to avoid project drift, ensure activities are on course to meet intended outcomes, maintain program integrity (Knowlton & Phillips, 2013), and report progress to stakeholders. ♦***i3 School-based Teams*:** Each middle school will have a team in place to provide school-level implementation guidance and oversight, including regular review and assessment of extended learning strategies, logistical support for mentoring strategies, assistance with marketing and recruitment efforts, guidance on PD strategies, and assistance with collecting data for program evaluation. ♦***Ongoing Evaluation and Feedback*:** Using an external evaluator will provide an unbiased assessment of our program and allow for continuous feedback and improvement. As described in Table 5, our objectives have clearly defined benchmarks that will be used to periodically assess our progress. Reviewing our progress toward meeting these benchmarks regularly will equip us to identify our successes and areas in which we need to improve implementation. Our evaluators will use multiple performance metrics and measures to monitor the program, including standardized assessments, teacher quality and performance data, educator and student surveys, and administrative records. Results from these assessments will help to identify barriers/facilitators to implementation; inform suggestions for overcoming barriers/promoting facilitators; and serve as the basis of

recommendations for improving key components of the program. Our evaluators will provide periodic feedback to each school and will triangulate the data to provide a synthesis of program wide implementation data to the district using interim and end-of-year reports, survey briefs, snapshots, and in-person briefings.

B4. Broad Dissemination to Support Replication: *GROW STEM* will bring together resources and partners across the region to support program success and long-term sustainability; we have several mechanisms in place to support dissemination, further development, and replication. ♦***Replication Guide*:** To support dissemination and replication, we will create a *GROW STEM* Implementation and Replication Guide, which will document key strategies, partnerships, staffing, and evaluation outcomes. This guide will be a guidebook for our entire model, allowing other school districts or organizations to plan and implement all core *GROW STEM* strategies. ♦***Program Website*:** We will create a program website to post program news, evaluation updates, and to disseminate our replication guide. Through ongoing marketing efforts to raise awareness for STEM and our program model, we will disseminate this program website broadly to the community and education and STEM professionals. ♦***STEM Conference Presentations and Publications*:** Our evaluation will provide ongoing feedback regarding the success of key strategies, and we will document these results through evaluation snapshots and annual reports. Starting in Year 3, once we have two full years of evaluation data, *GROW STEM* staff will begin to present key program results at regional and national STEM conferences (i.e., TN STEM Innovation Network; the National Science Teachers Association Annual STEM Forum; or Center for STEM Education for Girls conferences). By presenting in these forums, we will reach a broad audience of STEM education practitioners who can replicate or further build on our program model. ♦***i3 and U.S. ED Network*:** Our program model, evaluation, and publication results will be shared via the i3 and U.S. ED networks (including What Works Clearinghouse) to

ensure broad dissemination of our model nationally. ♦***Afterschool Program Networks*:** *GROW STEM* has broad implications for enhancing STEM exposure in a variety of afterschool settings. We will disseminate our replication guide through national, regional, and state-level afterschool networks (i.e., the Afterschool Alliance; 21st Century Community Learning Center state, regional, and national networks; and the TN Lottery for Education Afterschool Program network). ♦***Engineering Everywhere Network*:** *EE* has built a national network of universities, school districts, and organizations working to improve STEM instruction across the K-12 continuum. We will disseminate our results across this network by sharing our replication guide and "lessons learned" related to the use of *EE* targeting predominantly minority and low-income middle school girls.

C. QUALITY OF PROJECT EVALUATION

C1. Key Evaluation Questions to be Addressed: Confirmatory ▶ What is the impact of *GROW STEM* on student achievement in math and science for 8th grade girls after three years of programming? Exploratory ▶ What is the effect of *GROW STEM* on teacher TVAAS growth scores? To what extent do *GROW STEM* student participants matriculate into STEM academies? To what extent does *GROW STEM* increase student awareness of and aspiration toward STEM careers? We propose to answer our confirmatory evaluation question using a quasi-experimental design with 5th and 6th grade girls to look at achievement gains in eighth-grade TNReadyMath and Tennessee Comprehensive Assessment Program (TCAP) science scores. Table 9 depicts the evaluation method(s) and data sources we will use to address each of our key questions.

Table 9: *GROW STEM* Key Evaluation Questions and Corresponding Methods

Confirmatory question: What is the impact of *GROW STEM* on student achievement in math and science for 8th grade girls after three years of programming?	**Method:** QED study looking at 8th grade math and science (TNReadyMath and TCAP) achievement scores from a matched sample of 2016 5th and 6th grade girls
Exploratory question: What is the effect of *GROW STEM* on teacher TVAAS growth scores?	**Method:** analyze TVAAS gain scores from project year to project year for participating lead teachers

Exploratory question: To what extent do *GROW STEM* student participants matriculate into STEM academies?	**Method:** track *GROW STEM* participant matriculation into STEM academies after one, two, and three years of programming relative to non-participant peers
Exploratory question: To what extent does *GROW STEM* increase student awareness of and aspiration toward STEM careers?	**Method:** survey non- and participating students bi-annually on their understanding of and aspiration toward STEM careers

C2. Evidence of the Project's Effectiveness: *GROW STEM* will employ a rigorous QED individual-level single-cohort comparison design longitudinally to assess the effectiveness of our innovative project model with middle school girls. We will annually compare students and teachers in our seven target schools with well-matched students and teachers in the district. We will assess the treatment and control groups for differences in achievement outcomes on measures of standardized math and science **academic achievement—**TNReadyMath and TCAP scores—and math and science **academic growth** (TVAAS). In the first full academic year of the project, we will match 100 to 120 5th and 6th grade female participants in our seven target schools with girls from similar non-participating schools in the district, using the *GROW STEM* student recruitment criteria as the basis for the matching. We will use 1:1 propensity score matching to establish baseline equivalence between treatment and comparison students. The minimum detectable effect size needed for the study based on a sample size of 110 *GROW STEM* participants and 110 non-participants (total = 220 students), $\alpha = .05$, and power = .80, is 0.34. To complement the impact study, we will use a mixed-methods approach that combines qualitative and quantitative techniques which will allow the project to triangulate multiple sources of data thereby significantly enhancing the validity of the evaluation. The sources of quantitative data include: student course grades; grade point averages; TNReadyMath, science TCAP, and TVAAS scores; student and teacher surveys; Fidelity Implementation Index; and district and school administrative data. We will analyze quantitative data using descriptive statistics (means, standard deviations, frequencies, and percentages) and parametric and non-parametric inferential

statistics (chi square, t-tests, ANOVA); effect sizes will be computed between the two groups and broken out by subgroup, to include English learners and students with disabilities. The sources of qualitative data used to assess the implementation fidelity of the project include: interviews, focus groups, open-ended survey questions, observations, and mentor logs. Our logic model (Appendix D) illustrates our **strong theory** and provides an overview of the performance feedback loop that will supply our continuous improvement cycle and take place as a result of the evaluation. It provides a sound theoretical foundation from which to conduct the program evaluation, spells out desired outcomes, and dissects the crucial pieces of our plan, including program inputs, activities, outputs, and the extent to which activities have targeted the intended audience (Kellogg Foundation, 2004). To avoid program drift, we will revisit the logic model with stakeholders semi-annually to assess fidelity between *GROW STEM* in theory and the program in action, and help ensure that program activities are planned with a sufficient level of frequency, intensity, and duration to produce the desired outcomes. We will collect, analyze, and disseminate data to project personnel and the U.S. ED to ensure that timely and informed decisions about implementation are made throughout the life cycle of the program. We will collaborate with key program staff on development of a comprehensive **Fidelity Index**. The degree or level of implementation directly affects the intended outcome of the program (Century et al., 2010). The extent to which the program can monitor its degree of implementation and the fidelity of that implementation to the program theory will inform its continuous improvement. A fidelity index can serve as a composite measure of the degree of implementation, offering a lens for pinpointing strengths and weaknesses both in program delivery and in program theory. Identification of key program elements will comprise the foundation of our fidelity index. Documentation of program element outputs, such as teacher application of PBL principles and STEM resources, will both inform *GROW STEM* implementation and will furnish decision makers with essential data for model replication and program sustainability planning.

As indicated by the program goal and objectives identified in Table 5, our mixed-methods approach will employ multiple measures to document our process and benchmark our progress toward our outcome goals. Our reporting will take place at various intervals throughout the project. Formal reporting, such as the Annual Performance Report and a comprehensive evaluation report, will take place on a yearly basis. In addition, quarterly progress reports and less formal, ad hoc reports will be provided throughout the year so that progress may be tracked and refinements may be made. In order for *GROW STEM* to be developed, tested, and replicated further, we will thoroughly document and explain the structure of the project. For each key element we will describe: (1) service delivery according to length, intensity, and duration; (2) content, procedures, and activities subsumed under each key element; (3) roles, qualifications, and functions of staff responsible for service delivery-24; and (4) inclusionary and exclusionary characteristics defining our target population. In the likely event that the *GROW STEM* program design yields successful outcomes, this documentation of program structure will lay the groundwork for replication.

C3. Sufficient Resources to Evaluate the Project Effectively: We believe that investing in evaluation is tantamount to investing in our program's success. Identified as a preferred vendor through a competitive procurement process we conducted in 2014, The Evaluation Group (TEG) will serve as the independent, third-party evaluator for *GROW STEM*. TEG has over 20 years of demonstrated experience in planning, implementing, and evaluating large education grant programs funded at the federal, state, district, and local levels in the southeastern United States. TEG has expertise in all areas of evaluation including research design, measurement, benchmarking, test and survey construction, data analysis, and reporting. TEG's commitment to utilization-focused evaluation (Patton, 2008) positions them well to help our program understand its structural underpinnings with an eye toward future replication. TEG utilizes a multitude of data collection systems and online data collection software with the tools it needs for meeting its

performance measurement and reporting requirements in each program it evaluates. TEG provides for web-based data collection with a management platform specifically tailored to program evaluations, uses the Statistical Package for Social Sciences (SPSS) to analyze quantitative data, and develops program-specific coding schemes and matrices for treating qualitative data. Supported by a team that will include a data analyst and a process evaluation lead, Drs. Karyl Askew and Heather Scott will serve as co-principal investigators for our impact study. Each has extensive formal training in evaluation and measurement. Each has designed and led complex, multi-site, rigorous STEM-focused program evaluations, including i3 projects in North Carolina and Georgia. Drs. Askew and Scott will work with a team of evaluation professionals to carry out a study that will aim to meet What Works Clearinghouse evidence standards with reservations. MNPS and TEG agree to coordinate with national evaluation efforts, including technical assistance, analysis, and review provided by the U.S. ED or its contractor. MNPS will make broadly available through formal and informal mechanisms, and in print or electronically, the results of the evaluation. ♦***Performance Measures:*** In an effort to demonstrate the successful implementation of *GROW STEM* strategies, MNPS will: (1) implement the project with fidelity to the approved design; (2) provide evidence of our strategies' potential for improving student outcomes through both formative and summative assessments; (3) complete evaluations to identify key program elements and approach to facilitate further development, replication, or testing in other settings; and (4) document the cost per student served annually and cost per strategy for which success has been demonstrated.

Through an innovative, research-based STEM extended learning and mentorship model, our program will help *GROW STEM* achievement, engagement, and persistence among underserved girls; address gaps in the STEM pipeline; and help meet growing STEM workforce shortages.